

THE MOLLUSCA OF MAST HEAD REEF, CAPRICORN GROUP, QUEENSLAND.

PART I.

BY C. HEDLEY, F.L.S.

(Plates xxxvi.-xxxviii.)

Our revered founder, Sir W. Macleay, pointed to the Great Barrier Reef as a region especially worthy of the investigation of this Society and as a field of superlative importance to zoological students. Example being better than precept, he led the way by devoting wealth and energy to its exploration.

The results of his researches in the 'Chevert' on the marine fauna of tropical Queensland are published in the earlier volumes of these Proceedings.

The explorations of the 'Coquille,' 'Fly,' 'Rattlesnake,' 'Chevert' 'Alert' and 'Challenger,' and of Messrs. Saville Kent, Haddon and Semon, have made Torres Strait classic ground to the naturalist. South from Torres Strait to Sydney, in a distance of two thousand miles, no particular area has been systematically collected. Consequently we have no knowledge of how far the fauna of either extremity spreads, or where their constituents meet or overlap. Indeed, a vague impression exists that Torres Strait is hardly "Australian," and that the "Australian" fauna immediately succeeds it on the south. Thus the "Zoological Record" (Article Mollusca) includes Torres Strait in one Province and Queensland in another.

Perhaps the first and most important deduction to be drawn from the collection now under review is that the Torres Strait fauna flows unbroken down the whole length of the Great Barrier Reef. Indeed, meaning by Torres Strait an expanse of a thousand square miles of twelve fathom water, more Torresian

species are here noted from Mast Head than have been observed in any single area of like dimensions in Torres Strait itself. For this marine fauna I have already proposed* the title SOLANDERIAN.

Prompted by a wish to better define the distribution of the East Australian marine fauna, I suggested to several friends the advantage of examining the southern extremity of the Great Barrier Reef. Ease of access induced us to select Mast Head Reef as the point of investigation.

The writer was joined by Dr. R. Pulleine, Messrs. F. E. Grant, A. Liddell, H. C. Skeet, H. L. Kesteven and A. R. McCulloch. Leaving Sydney, 15th October, 1904, we reached Gladstone, Queensland, on the 19th. There we engaged a cutter of 15 tons burden, and after a rough trip landed on Mast Head on the 23rd. We pitched tents ashore and spent the week collecting on the reef, and dredging in its immediate vicinity. On October 31st we struck camp, packed and returned to Gladstone. Sydney was reached on November 7th. A popular account of our trip appeared in the 'Sydney Mail' of 7th December, 1904.

The Bunker and Capricorn Archipelagoes were visited by Prof. Jukes on H.M.S. 'Fly' in 1843, and I am not aware that any naturalist has worked there since. Jukes gave a description† of One Tree, Heron and Wreck Islands (not to be confused with Wreck Reef about 200 miles to the north-east). On the former he noted *Hippopus* and *Tridacna*. Our party failed to find the *Hippopus* on Mast Head. Probably the 'Fly' collectors obtained the *Scapha pulchra* Sowerby, which Gray has recorded‡ from Heron Island. Another rare Volute, *V. canaliculata* McCoy, has been reported under the name of *V. harfordi* from Wreck Island.§ As this reef is the nearest to a trunk railway, and therefore easiest to reach from the large cities of Australia, it will probably be revisited by scientific folk. For their use I preface

* These Proceedings, xxviii. 1904, p.880.

† Jukes, Voy. 'Fly,' 1847, i. pp.4-12.

‡ Gray, Proc. Zool. Soc. 1855, p.56.

§ Cox, Proc. Zool. Soc. 1869, p.358.

my account of the mollusca by a description of our collecting station.

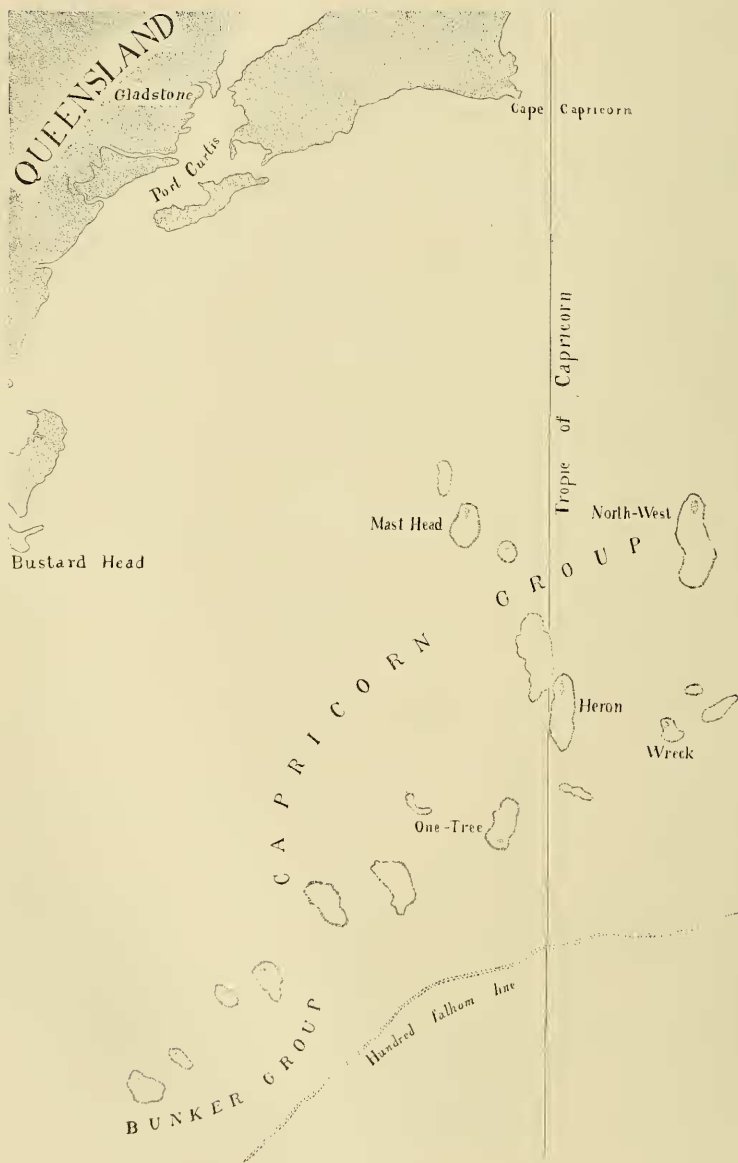
Mast Head Reef lies just outside the Tropic of Capricorn; it is the most western, and therefore nearest to the mainland, of a chain of reefs extending for 54 miles from North Reef to Lady Elliott Island. A continuation of the axis along which these reefs are arranged would pass through Beaksea Spit. Strictly speaking, this group is not a part of the Great Barrier, which terminates in a coral maze, Swain Reefs, north of the Capricorns. Between Swain Reefs and the Capricorns lies the broad and deep Curtis Channel. But for zoological purposes these pseudatolls may conveniently be regarded as a continuation of the Great Barrier.

The sketch map on the next page explains the position of the reef cluster.

At low tide Mast Head is exposed as an oblong reef about four miles from east to west and one and a half from north to south, its crest ten or twelve feet above the sea. It shrinks at high-water to a small but densely vegetated sandbank about 100 acres in extent, placed near the western end of the reef. The islet is level, raised but a few feet above the sea, and has no lagoonlet. Concentric undulations show the successive increase of beach built on beach. At the western end a clump of uprooted *Casuarinas* indicates where a gale had inflicted temporary loss.

On the south side a stratum of coral-sand-rock is now suffering denudation. Jukes has given* an excellent description and explanation of this rock. Though considerable literature has gathered on the subject, this account by Jukes seems not to have attracted the attention it deserves. As my own observations had independently brought me to the same conclusion, I will restate the case. This rock appears to originate as follows:—Water percolating through a drift of coral sand dissolves lime and carries it down to lower levels. Where the water stops lime is deposited, cements the sand grains and forms an obstruction for

* Jukes, Voy. 'Fly,' i. 1847, pp.7-9.



the arrest of subsequent influx. A continuation of the process builds the rock upwards. Like a stalactite, the coral-sand-rock derives its substance from a superincumbent mass of lime. I suggest that the coral-sand-rock can only form beneath a thick cover of sand, and that slow growth of the bank will provide for the increase of the rock. Briefly, the coral-sand-rock is the petrified core of beach or dune.

The islet was chiefly made of coarse sand. It may be laid down as a rule that, *the further from the reef edge an islet is built, the finer are the materials of which it is composed.*

A pit we sunk in search of water passed through foraminiferal sand with lumps of coral; it was bone-dry at a depth of eight feet. There was no surface water at the date of our visit.

For the most part the islet is fringed with *Casuarina* trees, whose weeping boughs overhang the water at high tide. Behind the shelter of these pioneers grow bushes of *Tournefortia*, *Sophora* and *Pandanus*, with grass and herbage of *Abutilon*, *Wedelia*, *Ipomaea*, &c. Further in the bushes become trees, and the grass and herbage disappear. The centre of the islet is overgrown by a dense *Pisonia* forest, forty or fifty feet in height, whose foliage completely screens the ground from the sunlight and strews it with fallen leaves. Among these were concealed two snails, a *Bifidaria* and a *Tornatellina*. The contrast between the cool shade within and the heat and glare of the beach is very sudden.

This islet is a refuge and breeding ground for sea-fowl. Some frigate birds were shot on the wing. The reef herons were hatching in the *Sophora* boughs. The noddy terns crowded the trees with nests. Fearless in their ignorance of man, they permitted us to approach them on their nests, but would not submit to be handled. The sooty petrels hurrying seawards before dawn, where our party slept across their track, would climb over our bodies as if we were logs of wood. By day and night the bush resounded with the hoarse cries of the sea-birds. The turtles were so plentiful that we never walked around the beach without seeing one. On a moonlight night I have passed twenty

ashore in as many minutes. Though we did not find their eggs the disturbed surface of the sand showed oviposition. From the ventral surface of the neck of one we killed for food, Mr. Kesteven collected a species of *Branchellion*.

The crest of the encircling reef is bared at about a quarter ebb, at which state of the tide it assumes the aspect of an atoll with a shallow lagoon enclosed by a rim of boulders. These dead coral blocks on the summit of the reef, locally called "nigger-heads," stand out against the sky like tombstones in a cemetery. They are composed of an enormous astrean coral, a species which does not occur between tide-marks, but doubtless is washed up by heavy gales from the submarine base of the reef. Once perched, these blocks do not travel. A mass of a cubic yard or so, which two men might overturn, sheltered a host of mollusca, tunicates, sponges and such-like cryptozoic fauna; these were tenants who anticipated a long lease of their abode. But the nigger-heads suffer great and rapid erosion, being worn into cavities like those of a melting mass of ice. Purple rock oysters are common on these blocks, and I noticed that all the aged oysters projected like spurs from the surface to which they were attached by the ventral margin. Originally they were fixed by the umbonal end, and as the first point of attachment wore away, they clung by the newer part of the valve. From the appearance of these oysters I deduce that in four or five years these nigger-heads have lost by erosion and solution a crust two inches thick. The presence of "pinnacles" on Mast Head has already been noted by Prof. A. Agassiz.* He is inclined to regard all such as remnants left from the erosion of a larger, more elevated mass. All nigger-heads which I have examined on the Queensland coast appear to me to be erratics. Had the surf planed down an elevated mass, I question if the last phase of degradation would assume this form.

As the ebb tide retreats, smaller blocks and broken branches of dead coral are seen strewn along the summit of the reef. Species

* Bull. Mus. Comp. Zool. xxviii. 1898, p.105. See also Saville Kent, 'Great Barrier Reef,' 1893, pl. xxx.B; and 'Naturalist in Australia,' 1897, p.143.

of *Turbinaria* have come to rest in the position of least resistance, the stem upwards, the basin down. The more fragile madrepores are only present as broken fragments. No living coral is seen at all on the reef crest, which is one long unbroken sepulchre of actinozoan life.

On the north side the nigger-heads were about twelve feet above low spring tide level. The outside of the reef descends this depth in places as a flight of shallow irregular pools and terraces, which reminded Mr. Grant and myself of the terraces of sinter which accumulate below a hot spring. When the lagoon has almost run dry, the shallow heated water is likely to hold an unusually large amount of lime in solution and to thus deposit it. The outer slopes of the reef are not encumbered by much coral, either dead or alive. On the leeward side they are grassed with green seaweed.

The crest of the reef acts as a dam-head to impound the waters of the lagoon from half-ebb to half-flood. No continuous barrier, however, stops the outflow of the water, which is merely choked and obstructed by the dead coral mass strewn along the crest. While the tide is down, the lagoon water trickles and dribbles away on all sides; here and there it finds a byewash through which it streams more freely.

So far as we could explore it, the lagoon floor is carpeted throughout with living coral. The coral takes the form of tables or dwarf hedges composed of interlacing masses of *Madrepora*, *Pocillopora*, *Porites*, *Turbinaria* and *Seriatopora*, in which odd *Fungia* may be entangled. These project from a level layer of foraminiferal sand to a height of one or two feet. One may walk continuously along the summit of a coral hedge for a hundred yards. From another such it may be parted by a sandy lane. The flattened tops of these corals are usually dead, and just project above water when, at quarter-flood, the lagoon is at its lowest. In places drifting sand had filled in the lanes and smothered the coral hedge. The lagoon impressed me as fast filling up.

Mast Head Reef, though sharing many features of the Coral Atolls of the Central Pacific, yet differs widely in detail, a difference due to the circumstances under which each arose. Typically the Central Pacific Reefs spring from abyssal depths, will have, have, or had a deep central lagoon, according to the stage in evolution attained. Their dry land is always greatest on the windward side and is built close to the reef edge.

Mast Head is a tabular mass set on a platform of about 20 fathoms, common to the archipelago. Its lagoon is almost obliterated; the depth at low water being expressed in inches instead of fathoms. The dry land is massed on the leeward side and heaped far within the margin of the reef.

In the Central Pacific the dry land of the atolls seems to have originated in the spasmodic action of hurricanes, which tear masses off the reef edge and stack them above high-water mark in "hurricane beaches." Between the hurricanes little change occurs. There the tides are small.

In contrast be it noted that Mast Head lies beyond the hurricane zone, but is subject to the action of enormous tides of a range of 14-15 feet. These tides race over the reef at a rate of two knots an hour, are the chief agents of island building, and operate with more regularity but less violence than the hurricanes.

The British marine mollusca were grouped by Forbes and Hanley into those of the Littoral, Laminarian and Coralline zones. An analogous but not parallel division of the Queensland marine mollusca may separate them into inhabitants of the mainland beaches, of the mangrove swamps, and of the coral reefs.* The latter fauna, with which we are now concerned, is again segregated into the mollusca of the surf-swept beaches, of the rocky zone from low-water to the mud-line, and of the flat expanse of soft white mortar-like mud beyond the rocks.

The swift currents that rush through the Capricorn Islands remove the mud. The two upper zones were here only available

* Tenison Woods, these Proceedings, v. 1881, p.107.

for study, and the lower produced almost all the new or remarkable shells noticed in the following pages. The sea-floor over which we dredged in a uniform depth of 17-20 fathoms, consisted of masses of living coral; budding reefs in fact, with intervening spaces of coarse sand and gravel, and here and there dense beds of kelp.

Various plant societies are termed in botanical language, "formations," thus a heather formation, a pine formation or a mangrove formation. We cannot adopt this nomenclature and express the mollusca associated with coral reefs as a "coral formation," because that term is already appropriated by geologists for a different meaning. Let us call it a madreporic assembly.

The first panoramic view of the coral-haunting mollusca was presented to science by the collection made by Hugh Cuming in the *Paumotu*. The following passages suggest the impression that the madreporic assembly characterises a geographic province, instead of being, as is really the case, a consequence of the special environment of clear and warm water.

"In the animal kingdom" Jukes* "was struck with the difference in the general aspect and character of the shells and echinodermata collected about Cape York and those got near Erroob." . . . "It was evident that in crossing Torres Strait we were passing from the Australian centre of life, so to speak, into that of the Indian Archipelago, or more strictly perhaps, of the Moluccas."

Mr. E. A. Smith wrote† of the marine mollusca of the Maldivé coral reefs:—"It is curious to observe that a larger proportion of them have been previously noted from . . . the Pacific, than from the Indian Ocean."

An account of the crustacea (*ante* pp.2-53, Pls. i-iv.) by Messrs. Grant and McCulloch has already been issued. Representatives of other groups have been handed to various specialists, and it is hoped that further reports on them may appear. We were

* Jukes, *Voy. 'Fly'*, i. 1847, p.298.

† Smith, *Fauna Maldivé, Laccadive Archipelagoes*, ii. 1905, p.589.

interested in finding a species of *Bonellia* in abundance in the lagoon. Though already reported from Sydney Harbour* and Cambridge Gulf, W.A.,† this genus has not yet been recorded from Queensland. The sporadic occurrence of *Bonellia*, *Pocillopora*, and similar tropical forms near Sydney, is probably due to the warm southerly current. Swept down by this, the Australian Gulf Stream, these northern forms incessantly attempt to colonise our coast, but perish.

In the space of a week no collectors, however diligent or expert, would expect to exhaust their station. The subsequent catalogue is not likely to enumerate more than half, if indeed as much, of the total molluscan fauna. The collection studied is presented to the Australian Museum.

Little is known of the minimum temperature corals can endure. The attention of visitors to this archipelago in spring or winter is especially invited to this subject. We had hoped to regularly record sea surface temperatures, but the distance to which the water retreated from our camp at low tide impeded our observations. The lowest reading registered was 65° Fahrenheit.

For the following observations I am indebted to Mr. Skeet :—

Outside the reef, October 23rd, 7 a.m., the sea surface temperature was 74° Fahrenheit.

In the lagoon, October 24th, 6.30 a.m., water 70°; 7 p.m., air 73°, water 75°. Oct. 25th, 9 a.m., air 74°, water (high tide) 67°. 3.15 p.m., air 75°, water 78°; 9 p.m., air 68°, water 69½°. Oct. 26th, 7.15 a.m., water (half-flood) 65°; 8 p.m., air 70°, water 72°. Oct. 27th, 7.45 a.m., air 75°, water (half-ebb) 69°; noon, air 85°; water 76°. Oct. 28th, noon, air 85°, water (high tide) 77°. Oct. 30th, noon, air 85°, water 75°.

In conclusion I would express my thanks to my companions, who, whatever their interests or occupations, were always on the look out for shells for me. I am especially indebted to Miss L. Parkes, who kindly undertook the wearisome task of sifting the

* Haswell, these Proceedings, x. 1886, p.331.

† Saville Kent, Proc. Roy. Soc. Q'land, vi. 1889, p.230.

small shells from the dredgings, a labour which occupied 650 hours.

To economise space the species are not noticed in detail. All identified, and many remain undetermined, are enumerated; those new to Australia and those new only to Queensland are marked as such. Fuller treatment is reserved for the new species or those of exceptional interest.

A future part will deal with the Gasteropoda.

BRACHIOPODA.

† *Crania suessi* Reeve.

† *Cryptopora brazieri* Crane

Megerlia sanguinolenta Gmelin.

CEPHALOPODA.

* *Sepia esculenta* Hoyle.

* *cultrata* Steenstrup.

† *pfefferi* Hoyle.

SCAPHOPODA.

Cadulus prionotus Watson.

POLYPLACOPHORA.

Callistochiton antiquus Reeve.

Cryptoplax burrowi Smith.

PELECYPODA.

Limopsis multistriata Forskal.

Arca foliata Forskal.

fusca Bruguière.

navicularis Bruguière.

clathrata Reeve.

* *Glycymeris cardiiformis* Angas.

* *capricornea* Hedley.

* *queenslandica* Hedley.

* *Philobrya scabra* Hedley.

* *recapitula* Hedley.

* New to Australia.

† New to Queensland.

- † *Philippiella rubra* Hedley.
 Vulsella vulsella Linn.
 Ostrea cucullata Born.
* *cerata* Sowerby.
 Pecten leopardus Reeve.
 pallium Linn.
 Chlamys senatorius Gmelin.
 Plicatula australis Lamarck.
 Lima lima Linn.
 bullata Born.
 angulata Sowerby.
 alata Hedley.
 fasciata Linn.
 Brachyodontes curvatus Dunker.
 Modiola philippinarum Hanley.
 australis Gray.
 Lithophaga teres Philippi.
 cinnamomea Lamarck.
 laevigata Quoy and Gaimard.
* *straminea* Dunker.
† *Modiolaria splendida* Dunker.
† *cuneata* Gould.
 cumingiana Dunker.
† *miranda* Smith.
* *perstriata* Hedley.
 Septifer bilocularis Linn.
* *Julia exquisita* Gould.
† *Pholadomya arenosa* Hedley.
† *Thraciopsis speciosa* Angas.
† *Thracia modesta* Angas.
 Myochama anomioides Stutchbury.
 Myodora trigona Reeve.
* *pulleinei* Hedley.

* New to Australia.

† New to Queensland.

- Cœlodon elongatus* Carpenter.
 * *Verticordia torrida* Hedley.
Cuspidaria brazieri Smith.
 * *Crassatellites janus* Hedley.
 * *Cuna flava* Hedley.
 † *delta* Tate and May.
Carditella torresi Smith.
Cardita variegata Bruguière.
 † *incrassata* Sowerby.
 * *Condylocardia porrecta* Hedley.
 * *trifoliata* Hedley.
 † *ovata* Hedley.
Chama pulchella Reeve.
jukesii Reeve.
 * *Codakia oblonga* Hedley.
bella Conrad.
interrupta Lamarck.
exasperata Reeve
 † *Diplodonta adamsi* Angas.
 † *Cryptodon globosum* Forskal.
Kellia cycladiformis Deshayes.
Cyamionactra mactroides Tate and May.
Cardium lyratum Sowerby.
transcendens Melv. and Standen.
fragum Linn.
bechei Reeve.
 † *hemicardium* Linn.
reevianum Dunker.
 * *skeeti* Hedley.
Tridacna elongata Lamarck.
Dosinia histrio Gmelin.
 * *amphidesmoides* Reeve.
 * *Gafrarium navigatum* Hedley.

 * New to Australia.

† New to Queensland.

- * *Gafrarium angasi* Smith.
- * *scriptum* Linn.
- Cytherea chemnitzii* Hanley.
- reticulata* Linn.
- lamellaris* Schumacher.
- Lioconcha castrensis* Linn.
- ornata* Dillwyn.
- * *Granicorium indutum* Hedley.
- * *Macrocallista roseotincta* Smith.
- Chione toreuma* Gould.
- subnodulosa* Hanley.
- marica* Linn.
- † *scabra* Hanley.
- * *recognita* Smith.
- Pitaria inflata* Sowerby.
- Petricola lapicida* Chemnitz.
- Tellina virgulata* Hanley.
- virgata* Linn.
- tenuilirata* Sowerby.
- * *dispar* Conrad.
- diluta* Smith.
- * *fabrefacta* Pilsbry.
- * *pulcherrima* Sowerby.
- * *gargadia* Linn.
- * *Arcopagia scobinata* Linn.
- † *robusta* Hanley.
- * *Semele exarata* Adams and Reeve.
- * *Abra truncata* Hedley.
- † *Sanguinolaria tenuis* Deshayes.
- Psammobia rasilis* Melvill and Standen.
- † *puella* Deshayes.
- † *gari* Linn.
- Asaphis deflorata* Linn.

* New to Australia.

† New to Queensland.

- † *Macra jacksonensis* Smith.
maculata Gmelin.
Lutraria oblonga Gmelin.
Atactodea striata Gmelin.
† *Ervilia biscalpta* Gould.
Corbula scaphoides Hinds.
crassa Hinds.
monilis Hinds.
† *Saxicava arctica* Linn.
Gastrochaena lamellosa Deshayes.

BRACHIOPODA.

CRANIA SUESSI Reeve.

Crania suessi Reeve, Conch. Icon. Crania, 1862, pl.i. fig.2.

A few worn valves from 17-20 fathoms are referred to this species with some hesitation. It has not been taken since the types were dredged off Sydney, half a century ago.

CRYPTOPORA BRAZIERI Crane.

Atrertia brazieri Crane, Proc. Zool. Soc. 1886, p.183.

(Plate xxxvi., figs.1-2.)

This brachiopod had hitherto been confined to the coast of New South Wales. It is quite common at 17-20 fathoms around Mast Head, where its favourite perch is the polyzoan, *Selenaria maculata* Busk.

MEGERLIA SANGUINOLENTA Gmelin.

Anomia sanguinolenta Gmelin, Syst. Nat. xiii. 1790, p.3347.

Megerlia sanguinea Davidson, Trans. Linn. Soc.(2) iv. Zool. 1887, p.108, pl.xx. figs.1-8.

In the dredgings from 17-20 fathoms this species occurred in profusion.

CEPHALOPODA.

SEPIA ESCULENTA Hoyle.

Sepia esculenta Hoyle, Chall. Rep. xvi. 1886, p.129, pl.xviii. figs. 1-5, pl.xviii. figs.1-6.

Several large shells gathered on the beach answer to the description of this Japanese species, which has not previously been seen beyond the Japanese Empire.

SEPIA CULTRATA Steenstrup.

S. cultrata Steenstrup, Hoyle, *op. cit.* p.133, pl.xx.

Numerous shells were strewn among the beach drift. This species had not been noted so far north.

SEPIA PFEFFERI Hoyle.

S. pfefferi Hoyle, *op. cit.* p.145, pl.i. fig.10.

Shells of this species occurred with the foregoing, but the species seemed rare. Hitherto it has only been known from the Arafura Sea.

PELECYPODA.

GLYCYMERIS CAPRICORNEA, n.sp.

(Plate xxxvi., figs.5-6.)

Shell small, solid, almost equilateral, the posterior side slightly exceeding the anterior, the orbicular outline only modified by the short hinge-line and a straight margin of the dorsal posterior. Colour white, variegated with irregular brown concentric streaks. Sculpture: about thirty-five strong sharp radial ribs which denticulate the margin, are wider apart and larger medially and shrink fainter and closer as they recede to the sides. The crests of the ribs are minutely beaded, and fine crossbars lattice the interstitial grooves. Epidermis disposed in separate, erect, falcate bristles set in a double row down each groove. Beaks full and projecting, approximating. Ligamental area short and narrow. Teeth about twenty-four, composing an arch with rather straight limbs. Interior porcellaneous-white, sometimes stained with

chocolate. Interior ventral margin provided with about twenty-six interlocking tubercles. Length 12.5 mm.; height 11 mm.; depth of single valve 4 mm.

Hab.—Several separate and perhaps immature valves dredged in 17-20 fathoms.

Obs.—The bold and even radial ribs sufficiently distinguish this small species from its Australian congeners. Forbes has noted that a new species of *Pectunculus* (possibly this one) was dredged by the 'Rattlesnake' from 15-17 fathoms on a sandy and shelly bottom off Cape Capricorn (Voy. 'Rattlesnake,' ii. p.366).

A single valve 27 mm. long and 23 mm. high was collected for me by Mr. H. L. Kesteven on the beach at Caloundra, Queensland, in September, 1902.

GLYCYMERIS QUEENSLANDICA, n sp.

(Plate xxxvi., figs.3-4.)

Shell rather small, inequilateral, transversely ovate, moderately inflated, anteriorly rounded, posteriorly subacuminate. Young shells are rounder; the posterior angle appears in adolescence and is most marked in aged individuals. Colour buff or pale purple, clouded with white towards the apex. Sculpture inconspicuous, consisting of minute radial riblets much broader than their interstices and minutely beaded by concentric sculpture. When full grown the riblets tend to aggregate into bundles of four or five composing low ribs which correspond to the denticles on the inner ventral margin. The epidermis appears as dense rows of minute bristles set in the grooves between the riblets, and as usual is thickest around the margin, leaving the umbo bald. Teeth, about twenty-three set in a low arch. Except the posterior dorsal margin, the inner edge of the valve is frilled by close, small, interlocking tubercles. Length 25 mm.; height 22 mm.; depth of single valve 7 mm.

This species was plentiful in the neighbourhood of Mast Head Reef at a depth of 17-20 fathoms.

I received from Mr. A. F. Hemsley a perfect specimen which he obtained near Cooktown, Queensland.

GLYCYMERIS CARDIIFORMIS Angas.

Pectunculus cardiiformis Angas, Proc. Zool. Soc. 1879, p.419, pl.xxxv. fig.6.

P. hoylei Melvill & Standen, Journ. Linn. Soc. Zool. xxvii. 1899, p.187, pl.xi. fig.24.

A handsome Glycymeris was dredged in all stages of growth. The largest was alive and contained several pearls; it measured, length 47mm., height 47mm., and depth of conjoined valves 35mm.; the radials were thirty-three. With some hesitation it is referred to the species named by Angas. The grooves are deep and squarely cut, and the ribs more scabrous than his description would imply, but he may have used a worn example. In shape and general appearance the figure of *P. robustus* Sowerby,* answers to our shell.

The species of Angas has not been since recognised. It came from the collection of Sylvanus Hanley. Macgillivray, who, dredged from H.M.S. 'Rattlesnake' in the vicinity of the Capricorns, supplied shells to Hanley.

PHILOBRYA SCABRA, n.sp.

(Plate xxxvii., figs.14-15.)

Valve small, nearly square in outline, solid, considerably inflated, very inequilateral. Colour various, chocolate, chrome-yellow, pink or purple, usually a monochrome but sometimes with an occasional dark spot. Epidermis not prominently developed, presenting a lustrous surface. Sculpture: from beneath the protoconch radiate about eighteen round ribs which strongly denticulate the margin and are divided by flat and broader interspaces. These ribs are largest medially and continue in force to the anterior margin, but on the posterior slope they rapidly degenerate and disappear. Concentrically the furrows are latticed by about

* Sowerby, Proc. Zool. Soc. 1883, p.21, pl.vii. fig.4.

twenty-five crossbars connected across the ribs by a hooded scale. Prodissoconch with a narrow rim, interior tumid with a central depression. No proper hinge-teeth are developed; their functions are probably discharged by about seventeen strong interlocking pits and tubercles, set without regard to the external sculpture around the broad inner margin of the valve. A wide chondrophore lies obliquely between a short anterior and a long posterior row of crenulations. Height 1.5 mm.; length 1.54 mm.; depth of conjoined valves 0.96 mm.

Numerous examples, both dead and alive, were taken in 17-20 fathoms.

P. scabra resembles *P. tatei*, from which, without a full series, I should not have ventured to separate it. A dense enveloping epidermis conceals the shell of *P. tatei* in life, but *P. scabra* is naked. Apart from the epidermis, I rely on the more numerous radials of *P. scabra* to distinguish it. The northern species is besides smaller, less inflated, more square in outline, and its anterior side less developed.

PHILOBRYA RECAPITULA, n.sp.

(Plate xxxvii., figs. 11, 12, 13.)

Shell subquadrate, the anterior side being undeveloped, causing it to be inequilateral, much inflated, solid. Colour white (?bleached). Sculpture: thirty-two concentric furrows traverse about forty-eight radii, of which fifteen are anterior and twelve posterior; on each of the resulting facets is set an elevated bead. The beads are conical, half imbedded on the long axis, the apex directed to the umbo, the base overhanging the furrow. They gradually increase in size to the margin. Prodissoconch large and conspicuous, with two rims set some distance apart; the inner basin is shallow triangular, its centre occupied by a prominent spike. Hinge: the ligament set obliquely between two crenulated areas. Under the anterior crenulation a single massive cardinal and socket, below and behind the posterior crenulation three laterals. Height 3 mm.; length 1.85 mm.; depth of single valve 0.9 mm.

Hab.—A few separate valves from 17-20 fathoms.

Obs.—The occurrence of a *Philobrya* in the coral fauna was unexpected. *P. recapitula* belongs to a group of radiate, inflated asymmetrical species of which the New Zealand *P. costata* was the first known. The exquisite sculpture will readily distinguish the present species, whose individuality is further marked in the hinge and complicated prodissoconch. The median spike of the latter presents inferences of wide interest. The hollows on the summits of the prodissoconch caps of certain species, for example, *Condylocardia concentrica* Bernard,* and *Philobrya parallelogramma*† may, it is now suggested, be the scars from which similar spikes have been shed. Such a spike appears on the prodissoconch of *Cyclopecten obliquus*.‡

Three stages of embryonic life are recorded in the prodissoconch of *P. recapitula*. The spike may be the stage for which Kesteven has proposed§ the name of *veloconch*.

MODIOLARIA PERSTRIATA, n.sp.

(Plate xxxvi., figs.9-10.)

Shell small, thin, oblong-elongate, rather inflated, umbo much incurved, situated at the anterior extremity. Colour, cream, with a few scattered brown spots. The unsculptured area characteristic of the genus falls within the anterior third; it is here reduced to a narrow ray the width of three grooves and ridges. Sculpture: the specimen drawn has, posterior to the smooth ray, 104 sharp raised radial threads parted by deep grooves of equal breadth. The threads increased in size with the growth of the shell and are largest at the posterior dorsal angle. New threads appear by intercalation. The margin is finely crenulated by the radial sculpture. Anterior to the smooth ray are 18 similar threads and grooves. The radials are crossed and broken by about 40

* Journ. de Conch., xlv. pl. vi.

† These Proceedings, Vol. xxx., pl. xxxii., fig. 16.

‡ Mem. Austr. Mus. iv., p. 306, fig. 51.

§ These Proceedings, xxx., p. 327.

fine concentric lamellæ. Length 5 mm.; height 3 mm.; depth of single valve 1.85 mm.

Not uncommon as separate valves in 17-20 fathoms.

The numerous delicate radials and the very narrow smooth ray afford recognition marks for the distinction of the species.

JULIA EXQUISITA Gould.

Julia exquisita Gould, Smith, Chall. Rep. xiii. 1885, p.269.

Several dead and separate valves were found among the dredgings. One perfect vivid green shell adhered to a strip of green seaweed. This interesting species adds a family to the Australian fauna. Previously it had only been found at Bourbon and Hawaii.

MYODORA PULLEINEI, n.sp.

(Plate xxxvi., fig.7.)

Shell moderately solid, elongate, nearly equilateral, left valve plane, right much compressed. Colour white. Dorsal margins nearly straight, meeting in a hook at the umbo. Posterior end broadly and obliquely truncate, anterior angular. Sculpture: about ten concentric, graduated, broad and high corrugations, which are sharply bent on crossing an imaginary line between the umbo and the postero-dorsal angle. In the left valve the crests of the ridges are acute, in the opposite valve rounded. A high magnification exhibits a secondary sculpture of dense minute grains arranged radially. Length 6 mm.; height 4 mm.

Rare; a few separate valves from 17-20 fathoms.

This species is named in honour of the well-known conchologist, Dr. R. Pulleine, who accompanied our party to Mast Head.

CÆLODON ELONGATUS Carpenter.

Carpenter, Proc. Zool. Soc., 1864, p.600.

(Plate xxxvii., fig.16.)

An unfigured species cannot safely be identified except by those fortunate enough to have access to authentic specimens. The record by the 'Challenger' of *C. elongatus* from Torres Strait suggested that name for a specimen here figured, which is

5 mm. high, 9.5 mm. long; and was dredged in 17-20 fathoms, off Mast Head Island.

VERTICORDIA TORRIDA, n.sp.

(Plate xxxvii., figs. 17, 18, 19.)

Shell small, rather inflated, subrhomboidal. Right valve exceeding and clasping the left. Umbo much incurved, on its summit a small smooth sharply defined prodissoconch. Lunule deeply excavate. Dorsal area flattened. Colour uniform clear amber. Sculpture: the whole surface of the valve ornamented with numerous faint radial riblets, separated by flat interspaces; both riblets and interspaces crowded with sharp and very minute grains. Interior highly nacreous, external radial sculpture impressed between the pallial line and the margin. In the right valve a massive cardinal under the umbo and a lateral under the dorsal margin. Height 3 mm.; length 3.25 mm.; diameter of conjoined valves, 1.1 mm.

A few living specimens from 17-20 fathoms.

CRASSATELLITES JANUS, n.sp.

(Plate xxxviii., figs. 29, 30, 31, 32.)

Shell small, much compressed, subtrigonal, slightly inequilateral. Colour buff to orange, with two or three interrupted rays of chocolate and grey; the interior brown in the centre. Sculpture: about sixteen concentric folds which become broader, higher and more widely spaced as the shell grows. The inner margin of the valve is smooth. The prodissoconch, worn away in mature specimens, is shown (fig. 32) in a shell 0.47 mm. in height. Each prodissoconch rises from a rounded collar in a double-peaked protuberance. Length 4.55 mm.; height 4.0 mm.; depth of single valve 1.5 mm.

Numerous specimens in 17-20 fathoms.

CUNA FLAVA, n.sp.

(Plate xxxviii., fig. 28.)

Shell small, solid, subtriangular, compressed. Colour monochrome, usually orange, sometimes pink or purple. Sculpture:

about twenty-two radial ribs parted by narrow though deep grooves, and densely packed with compressed beads which enlarge gradually with the growth of the shell. It is the chief peculiarity of the species that these ribs do not diverge from the umbo, but centre at a point in space considerably beyond the shell. Lunule and impressed dorsal area are unsculptured. About eighteen small interlocking tubercles on the inner ventral margin. Height 1.7 mm.; length 1.65 mm.; depth of conjoined valves 1 mm.

An abundant species in 17-20 fathoms.

CONDYLOCARDIA PORRECTA, n.sp.

(Plate xxxviii., fig.24.)

Shell larger than is usual in the genus, solid, rhombic-oblong, inequilateral, anterior end short. Colour white. Sculpture: about fourteen low broad radial ribs, parted by narrow grooves and crossed by delicate growth-lines. Anterior and posterior dorsal areas smooth. Prodissoconch large, with projecting rim, and containing a second inner shield upon the umbo. From within the ribs are visible because more opaque than their interstices; their ends strongly denticulate the inner margins of the valves. Height 1.9 mm.; length 2.5 mm.; depth of conjoined valves 1.3 mm.

A few examples dredged from 17-20 fathoms.

CONDYLOCARDIA TRIFOLIATA, n.sp.

(Plate xxxvii., figs.20, 21, 22, 23.)

Shell solid, inflated, oblique, much higher than long, triangularly ovate, with a flattened anterior area like a lunule. Surface glistening in the light. Colour pale ochre, passing into pearly white on the umbo. There is no radial sculpture; about twenty strong corrugations undulate the middle of the valve, diminish posteriorly, and cease anteriorly. Prodissoconch large, with expanded upturned margin projecting over the main shell. An umbonal boss bears a trefoil scar, and is surrounded by two concentric ridges. Hinge massive; left valve with an anterior and

a stronger posterior cardinal, right with one anterior and two posterior cardinals. In the left valve the posterior inner margin is furrowed, and the anterior ridged to clasp corresponding elevations and depressions in the other valve. Muscular impressions distinct. Height 1.4 mm.; length 1.22 mm.; diameter of conjoined valves 0.84 mm.

Several living specimens from 17-20 fathoms. [Since this was written Miss L. Parkes has obtained several separate valves of this species in Middle Harbour, Sydney].

CODAKIA OBLONGA Hedley.

Lucina oblonga Hedley, Mem. Austr. Mus. iii. 1899, p.497, fig.51.

This species was described from Funafuti. A few separate valves were taken in 17-20 fathoms off Mast Head.

CARDIUM SKEETI, n.sp.

(Plate xxxviii., fig.25.)

Shell small, obliquely cordate, inflated, inequilateral, rather thin. Colour: different individuals are various shades of lemon, lilac, pink or purple; in pale specimens with dark concentric streaks on the posterior side. Sculpture: about thirty-eight radials densely crowded with sharp imbricating hooded scales which give a harsh aspect to the shell and extend over the whole surface. These are parted by deep and narrow grooves, latticed by minute densely disposed crossbars, and produced at the margin as interlocking teeth, posteriorly long, acute, anteriorly short and blunt. Length 8 mm.; height 6 mm.; depth of single valve 3 mm.

This is an abundant species in 17-20 fathoms. It is named after Mr. H. C. Skeet, a member of the Expedition.

GAFRARIUM NAVIGATUM, n.sp.

(Plate xxxviii., fig.33.)

Shell small, equilateral, broad cordate, very solid, rather compressed. Umbo sharply pointed. Lunule long and narrow. Colour white, rose, or orange, with a few scattered brown dots.

Sculpture: down the centre of the valve runs a parting line where follow arrow-heads, each limb stretching to the margin in a broad crescentic wave. The general effect is that of waves in the wake of a fast moving vessel, which would in this case be steering from the ventral margin to the umbo. The double crescents number about fifteen, commence as an arcuate ridge, successively broaden and meet at a sharper angle, are parted by shallow furrows of equal breadth whose ends undulate the lateral margins. Over ridge and furrow runs undisturbed a regular fine concentric striation. Muscular impressions normal. Ligament sunk almost to the centre of the hinge-plate. Length 6 mm.; height 5.4 mm.; breadth of single valve 1.6 mm.

Hab.—Several specimens, some alive, from 17-20 fathoms.

Obs.—The remarkable sculpture of this pretty little species readily distinguishes it. Judging from literature, it approaches nearest to *Circe æquivoca* Chemnitz, but differs by being much smaller, more equilateral, and of bolder sculpture. The latter feature recalls waves spreading in the wake of a vessel.

GRANICORIUM, gen. nov.

A genus of the Veneridæ, nearest to *Lioconcha*, which it resembles in shape, solid porcellaneous shell and muscular impressions; but from which it differs by the absence of anterior lateral teeth, the want of a groove defining the lunule, and by the habit of plastering the exterior with sand. Type *G. indutum* Hedley.

GRANICORIUM INDUTUM, n.sp.

(Plate xxxviii., figs. 26, 27.)

Shell convex, suborbicular, straight on dorsal margin, angled posteriorly and rounded ventrally. Umbo incurved. Lunule deeply excavate. Except the tip of the umbo, the whole of the outside of the valve is densely covered with sand grains, including broken bits of shells, corals, and foraminifera. These grains are so firmly cemented to the valve that it is difficult to remove them. The fragments increase in size towards the margin, and are arranged to slightly overlap each other like tiles on a roof.

Beneath the coat of sand the valve is flesh-coloured, and concentrically sculptured. Interior porcellaneous, sometimes white, sometimes orange-buff. Inner margin smooth, bevelled. Pallial line slightly sinuate. Hinge with three cardinals in each valve, the posterior grooved, no laterals. Length 19 mm.; height 17 mm.; depth of single valve 6 mm.

Several separate valves from 17-20 fathoms.

MACROCALLISTA ROSEOTINCTA Smith.

Cytherea (Callista) roseotincta Smith, Chall. Rep. Zool. xiii. 1885, p. 136, pl. i. figs. 6-6b.

This species is new to Australia; indeed it appears only to have been taken once, in the Philippine Islands. Numerous dead shells were dredged in 17-20 fathoms around Mast Head.

TELLINA FABREFACTA Pilsbry.

Pilsbry, Proc. Acad. Nat. Sci. Philad. 1904, p. 555, pl. xli. figs. 11-12.

On receiving a paper from Dr. Pilsbry on some new Japanese molluscs, I at once recognised the figure of this as one which commonly occurred in 17-20 fathoms off Mast Head. The identification was confirmed by the author of the species, who was surprised to receive his novelty from so remote a locality.

ABRA TRUNCATA, n.sp.

(Plate xxxviii., fig. 34.)

Shell thin, compressed, a long and narrow wedge, the dorsal and anterior margins forming a right angle, posterior and ventral margins rounded. Colour white. Sculpture: concentric elevate lamellæ, wide-spaced and prominent posteriorly, finer and crowded towards the umbo, arrested abruptly on reaching the dorsal area, across which they continue as fine threads. No muscle-scars are perceptible on the glazed interior. The abbreviation of the anterior side has probably contracted the hinge. In the single left valve before me it appears to consist of a medium oblique deeply entering chondrophore and a well developed anterior and posterior lateral. Height 3.6 mm.; length 7 mm.; depth of single valve 1 mm.

A separate valve from 17-20 fathoms.

ERVILIA BISCUPTA Gould.

Smith, Chall. Rep. Zool. xiii. 1885, p.80.

(Plate xxxvi., fig.8.)

This species was dredged in abundance round Mast Head Island. In Australia it has only hitherto been recorded from Sydney, where it is extremely rare. The figure of it* is so unlike our specimens that I offer a drawing of a Queensland example 5.5 mm. long and 3.6 mm. high.

EXPLANATION OF PLATES.

Plate xxxvi.

Figs.1, 2.—*Cryptopora brazieri* Crane.

Figs.3, 4.—*Glycymeris queenslandica* Hedley, and enlarged sculpture.

Figs.5, 6.—*Glycymeris capricornea* Hedley, and enlarged sculpture.

Fig.7.—*Myodora pulleinei* Hedley.

Fig.8.—*Ervillea bisculpta* Gould.

Figs.9, 10.—Different aspects of *Modiolaria perstriata* Hedley.

Plate xxxvii.

Figs 11, 12, 13.—*Philobrya recapitula* Hedley; exterior of valve, magnified sculpture, and hinge.

Figs.14, 15.—*Philobrya scabra* Hedley; exterior of valves and hinge.

Fig.16.—*Cœlodon elongatus* Carpenter.

Figs.17, 18, 19.—*Verticordia torrida* Hedley; exterior of valve, profile, and hinge.

Figs.20, 21, 22, 23.—*Condylocardia trifoliata* Hedley; exterior of valve, profile, and hinge.

Plate xxxviii.

Fig.24.—*Condylocardia porrecta* Hedley.

Fig.25.—*Cardium skeeti* Hedley.

Figs.26, 27.—*Granicorium indutum* Hedley; interior and exterior.

Fig.28.—*Cuna flava* Hedley.

Figs.29, 30, 31, 32.—*Crassatellites janus* Hedley; adult, interior and exterior; young, side-view and profile.

Fig.33.—*Gafrarium navigatum* Hedley.

Fig.34.—*Abra truncata* Hedley.

* Angas, Proc. Zool. Soc. 1877, pl.xxvi. fig.21.